

FEMA REGION V

short notes on planning #22

MITIGATING FOR EARTHQUAKES

People living and working in the West have experienced more frequent seismic events and may be more familiar with earthquake mitigation, but to the rest of the country experiencing and mitigating potential damages from an earthquake may be a new experience. This document is meant to give residents and officials of the central United States an overview of what should be included in an mitigation plan that addresses seismic hazards and risks, the information needed for a hazard identification and risk assessment, and the types of actions that should be considered in an earthquake mitigation strategy.

Who To Turn To For Assistance

There are a number of places that a community can turn to for assistance in preparing the seismic portion of the all-hazard mitigation plan. The first place to contact is the State Emergency Management Agency (EMA). The State Hazard Mitigation Officer may be able to provide help, and a number of states EMA's have an Earthquake Program Manager. This individual is an expert on seismic hazards, seismic maps and the various mitigation activities. The State Earthquake Program Managers in Region V are:

- Illinois: Jana Fairow – (217) 557-4766
- Indiana: John Steel – (317) 233-6519
- Ohio: Candace Sherry – (614) 889-7172

There are also a number of other places a community can obtain information on earthquakes. For information on the earthquake hazard, both your state geological survey and the U.S. Geological Survey (USGS) should be able to provide you information regarding whether you are located in an earthquake zone. The USGS maintains a web site that identifies earthquake hazard zone. You can access this site by going to

<http://geohazards.cr.usgs.gov/eq/pubmaps/US.pga.050.map.gif>. You can also order maps on a CD-ROM by going to the USGS website at <http://www.usgs.gov>.

For information on how to address the earthquake hazard, FEMA has several publications that can help. They are:

- “Seismic Considerations for Communities at Risk (FEMA-83),”
- “A Non-Technical Explanation of the NEHRP Recommended Provisions (FEMA-99),”
- “Rapid visual Screening of Buildings for Potential Seismic Hazards (FEMA-154/155),”
- “Home Builder’s Guide to Seismic Resistant Construction (FEMA-232),” and
- “Promoting the Adoption and Enforcement of Seismic Building Codes: A Guide for State Earthquake and Mitigation Managers (FEMA-313).”

All of these publications may be ordered free of charge from FEMA by calling 1-800-280-5250.

Finally, you can also contact the Earthquake Consortium for the middle and southeastern portion of the country, the Central United States Earthquake Consortium (CUSCEC). They can be contacted on the Internet at <http://www.cusec.org>.

Hazard Identification

The easiest ways to determine a jurisdiction’s seismic risk are to use the USGS’s website listed above and/or order the Probabilistic Earth Ground Motion Maps from the USGS. Another place to obtain seismic maps is by ordering FEMA publication “NEHRP Recommended Provisions For Seismic Regulations For New Buildings and Other Structures Kit (FEMA-368/369).” This kit includes the seismic maps for the continental US. You can order the publication by calling 1-800-480-2520.

Once you have found the location of your community on the Maximum Considered Ground Motion Maps described above, which are based on a 2% probability of exceedance in 50 years, determine if the ground motion exceeds a short period spectral response acceleration of 0.15 and exceeds a one second period spectral response acceleration of 0.04. If so, you should consider earthquakes to be a hazard that will affect your community and determine what actions your community needs to take.

HAZUS

One of the best ways to complete a risk assessment for seismic hazards is through the use of the FEMA’s HAZUS loss estimation program’s earthquake module. This computer program in association with a GIS system will enable your community to estimate the location and the amount of damage and injuries from an earthquake of a particular magnitude. Products that a HAZUS run produces include maps based on census tracts showing the location of various facilities and how they

will be affected by a risk assessment in the Central U.S., you should be cognizant of two conditions that may accentuate the damages.

Unlike the mountainous west where bedrock comes close to the earth’s surface, the Midwest and East

will be affected by an earthquake of a given magnitude, charts showing how many structures will be damaged, the types of damage and the monetary value of the damages, figures on how many people will be expected to be injured or killed, and even the amount of debris that will be expected.

Copies of the HAZUS Software may be obtained from the FEMA Warehouse. More information on HAZUS and HAZUS training is available of the FEMA Website <http://www.fema.gov>.

SPECIAL CONSIDERATIONS

When completing a risk assessment in the Central U.S., you should be cognizant of two conditions that may accentuate the damages.

Unlike the mountainous west where bedrock comes close to the earth's surface, the Midwest and East are covered with **unconsolidated soils** that will conduct the waves produced by an earthquake over a much greater area. It has been estimated that while the 1811 and 1812 New Madrid earthquakes that occurred in the Midwest were roughly similar to the 1906 San Francisco earthquake, they affected over 10 times the area. This would impact a much larger population.

The second consideration is **construction standards**. Communities in the West have addressed seismic standards in their building codes for many years, but building codes in the Midwest have adopted seismic provisions only recently, and enforcement is only now beginning to occur in many areas. The impact is that a severe earthquake would potentially affect more structures and with greater damage than for those structures in the West.

MITIGATION ACTIONS

Seismic mitigation can take a number of forms from public information, to preparing for the primary and secondary affects of earthquakes, to adopting or modify building codes, to modifying existing critical structures.

The first step in mitigating against an earthquake is to prioritize what you wish to protect. It is recommended that you first look at critical facilities, since these facilities house the first responders, this will be from where the response and recovery is coordinated, or be from where medical attention or shelter is provided. The second priority should include the lifelines for your community. This is the critical infrastructure that provides electricity, water, and heat to your community. If these utilities are forced to shut down, your community may have to provide shelter to many more individuals. The third priority should be commercial and industrial buildings or large apartment or condominium buildings. Due to the types of construction, these are the types of structures that can be the most severely impacted by an earthquake. The final priority should be standard single-family residential structures. Usually, because of their light-weight construction, single-family structures suffer the least damage. However, they may still suffer enough damage to require the community to provide temporary housing.

Possible mitigation actions may include:

School Survey Procedures	Schools are critical facilities not only because of the special population they accommodate, but also because they are often identified as shelter sites for a community. Due to this sheltering role, it is essential that these buildings function after a seismic event. A community can use the survey procedure and guidance contained in FEMA's Rapid Visual Screening documents to inventory structural and non-structural hazards in and near school buildings. Survey results can be used to determine mitigation priorities that can be incorporated into capital improvement plans.
Capital Improvement Planning	School districts, local governments, corporations, and others have developed capital improvement plans to ensure that facilities remain operational for years down the road. It is more efficient and cost effective to incorporate structural and non-structural seismic strengthening actions into on-going building plans and activities, rather than to rehab later.
Guidelines and Model Ordinances	Earthquake risks can be mitigated through land use planning. Communities can develop and distribute guidelines or pass ordinances that require developers/building owners to locate lifelines, buildings, critical facilities, and hazardous materials out of areas subject to significant seismic hazards. Particular consideration should be given to enforcing such ordinances in areas with steep slopes or subject to ground displacement, severe ground shaking, or liquefaction.
Building Codes	Although land use management that avoids building on hazardous sites is an effective way to reduce earthquake risk, all structures will be subject to ground shaking. Engineers and architects have designed buildings in ways that reduce the impact of ground shaking, which is the major cause of earthquake damage. Encouraging all local governments to adopt and enforce updated building code provisions is one effective way to reduce earthquake damage risk.
Seismic Code Training	Legislators often enact seismic building provisions that do not get enforced because architects, engineers, and building departments are unaware of the provisions. Conducting information sessions or other forms of outreach on seismic code provisions for new and existing buildings can enhance code use and enforcement by local architects, engineers, contractors and code enforcement personnel.
Buildings as Structural Hazards	Homeowners and businesses can take simple measures to strengthen their buildings before the next earthquake. Bracing walls and bolting sill plates to the foundation are examples. Unreinforced masonry buildings and non-ductile concrete facilities are particularly vulnerable to ground shaking. These buildings should be strengthened and retrofitted against future seismic events.
Non-Structural Hazards	Many injuries in earthquakes are caused by nonstructural hazards, such as attachments to all types of buildings. These include lighting fixtures, windows (glass), pictures, tall bookcases, computers, ornamental decorations on the outside of the buildings (like parapets), gas lines, etc. Activities that can reduce the risk of injury and damage include: anchoring tall bookcases and file cabinets, installing latches on drawers and cabinet doors, restraining desktop computers and appliances, using flexible connections on gas and water lines, mounting framed pictures and mirrors securely, and anchoring and bracing

propane tanks, water heaters and gas cylinders.

Technical Assistance for Homeowners	Developing a technical assistance information program for homeowners and teaching them how to seismically strengthen their houses can be an effective mitigation activity. The program could include providing local government building departments with copies of existing strengthening and repair information for distribution to homeowners. Other potential distribution sources include insurance companies, realtors, homeowner associations and libraries.
Infrastructure Hardening	Identification and hardening of critical lifeline systems, i.e., critical public services such as utilities and roads, to meet "Seismic Design Guidelines and Standards for Lifelines," or equivalent standards, may distinguish a manageable earthquake from a social and economic catastrophe.
Bridge Strengthening	State and local highway departments should review construction plans for all bridges to determine their susceptibility to collapse. Problem bridges should be prioritized for upgrading and retrofitted.
Hazard Mitigation Awareness	Local or state governments can use community outreach activities to foster an awareness of the existing earthquake hazard, the resulting risks to buildings and infrastructure, and earthquake mitigation activities that can be undertaken in homes, schools and businesses.
Financial Incentives	Local or state governments can support financial incentives like low interest loans or tax breaks for home and business owners who seismically retrofit their structures.
Insurance	Local or state governments can work with insurance industry representatives to increase public awareness of the availability of earthquake insurance.